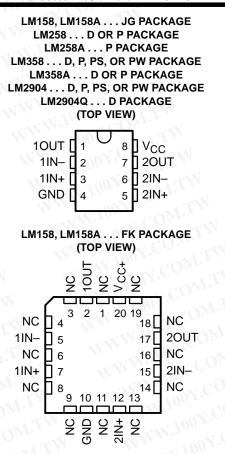
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- Wide Range of Supply Voltages:
  Single Supply ... 3 V to 30 V (LM2904 and LM2904Q ... 3 V to 26 V) or
   Dual Supplies
- Low Supply-Current Drain Independent of Supply Voltage ... 0.7 mA Typ
- Common-Mode Input Voltage Range Includes Ground, Allowing Direct Sensing Near Ground
- Low Input Bias and Offset Parameters:
   Input Offset Voltage ... 3 mV Typ A Versions ... 2 mV Typ
  - Input Offset Current . . . 2 nA Typ
  - Input Bias Current . . . 20 nA Typ A Versions . . . 15 nA Typ
- Differential Input Voltage Range Equal to Maximum-Rated Supply Voltage . . . ±32 V (LM2904 and LM2904Q . . . ±26 V)
- Open-Loop Differential Voltage Amplification . . . 100 V/mV Typ
- Internal Frequency Compensation

#### description/ordering information

These devices consist of two independent, high-gain, frequency-compensated operational amplifiers designed to operate from a single supply over a wide range of voltages. Operation from split supplies also is possible if the difference between the two supplies is 3 V to 30 V (3 V to 26 V for the LM2904 and LM2904Q), and V<sub>CC</sub> is at least 1.5 V more positive than the input common-mode voltage. The low supply-current drain is independent of the magnitude of the supply voltage.

#### LM158, LM158A, LM258, LM258A LM358, LM358A, LM2904, LM2904Q DUAL OPERATIONAL AMPLIFIERS SLOS068E – JUNE 1976 – REVISED SEPTEMBER 2002



NC - No internal connection

Applications include transducer amplifiers, dc amplification blocks, and all the conventional operational amplifier circuits that now can be implemented more easily in single-supply-voltage systems. For example, these devices can be operated directly from the standard 5-V supply used in digital systems and easily provide the required interface electronics without additional ±5-V supplies.

The LM2904Q is manufactured to demanding automotive requirements.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



Copyright © 2002, Texas Instruments Incorporated On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

#### LM158, LM158A, LM258, LM258A LM358, LM358A, LM2904, LM2904Q DUAL OPERATIONAL AMPLIFIERS

SLOS068E - JUNE 1976 - REVISED SEPTEMBER 2002

#### description/ordering information (continued)

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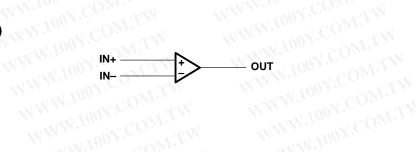
Http://	www.	100y.	com.	tw
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TA	V <sub>IO</sub> max AT 25°C	PAC	KAGE <sup>†</sup>	ORDERABLE PART NUMBER	TOP-SIDE MARKING
N.COM.	N	PDIP (P)	Tube	LM358P	LM358P
101.00. 1001.COM			Tube	LM358D	
)°C to 70°C	7 mV	SOIC (D)	Tape and reel	LM358DR	LM358
000 to 7000	WT	SOP (PS)	Tape and reel	LM358PSR	L358
	W	TSSOP (PW)	Tape and reel	LM358PWR	L358
0°C to 70°C	1.1	PDIP (P)	Tube	LM358AP	LM358AP
	3 mV		Tube	LM358AD	
1004.00	WTI	SOIC (D)	Tape and reel	LM358ADR	– LM358A
NN. ON.C	85°C 5 mV	PDIP (P)	Tube	LM258P	LM258P
25°C to 95°C	5 mV		Tube	LM258D	
-25°C 10 85°C	5 mV 3 mV	SOIC (D)	Tape and reel	LM258DR	LM258
-25°C to 85°C	3 mV	PDIP (P)	Tube	LM258AP	LM258AP
WWW.	V.COM	PDIP (P)	) Tube LM2904P LM2904P		LM2904P
	V COM	SOIC (D)	Tube	LM2904D	LM2904
			Tape and reel	LM2904DR	LIVI2904
-40°C to 125°C	7 mV		Tube	LM2904QD	2904Q
	ON.CU		Tape and reel	LM2904QDR	2904Q
	V C	SOP (PS)	Tape and reel	LM2904PSR	L2904
	1.1001	TSSOP (PW)	Tape and reel	LM2904PWR	L2904
A Va .	N 100Y.	CDIP (JG)	Tube	LM158JG	LM158JG
	5 mV	CDIF (30)	Tube	LM158JGB	LM158JGB
-55°C to 125°C	14.100	LCCC (FK)	Tube	LM158FKB	LM158FKB
-55 0 10 125 0	W.100	CDIP (JG)	Tube	LM158AJG	LM158AJG
	2 mV	ODI (00)	Tube	LM158AJGB	LM158AJGB
	NWW.	LCCC (FK)	Tube	LM158AFKB	LM158AFKB

#### ORDERING INFORMATION

WWW.100Y.COM.T <sup>†</sup> Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

#### symbol (each amplifier)

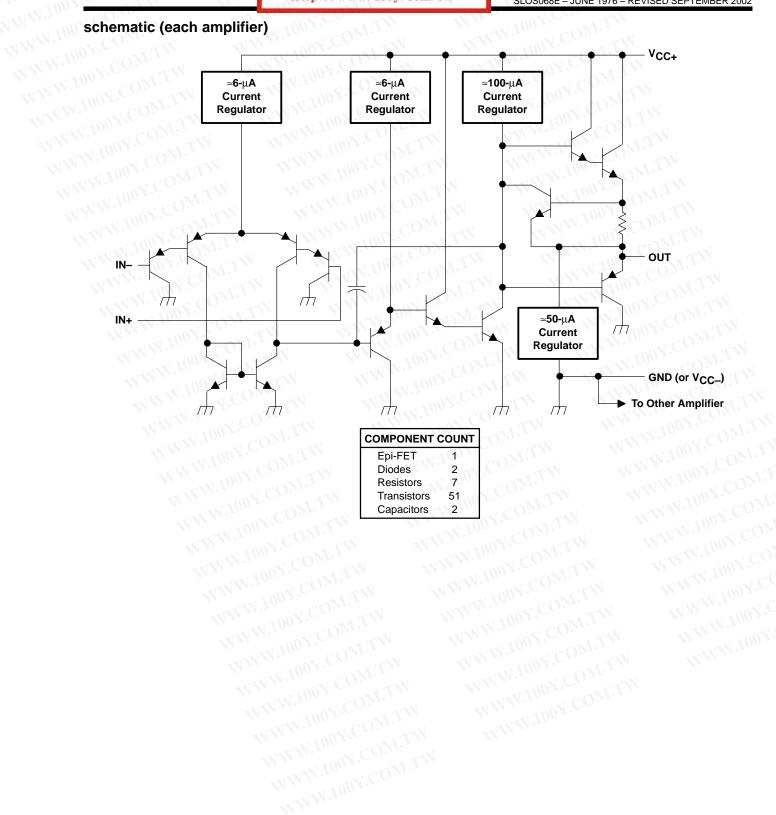






LM158, LM158A, LM258, LM258A LM358, LM358A, LM2904, LM2904Q DUAL OPERATIONAL AMPLIFIERS SLOS068E - JUNE 1976 - REVISED SEPTEMBER 2002

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SLOS068E - JUNE 1976 - REVISED SEPTEMBER 2002

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#### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

100Y.COM.TW WWW.100Y.COM	WIN WILL	LM158, LM158A LM258, LM258A LM358, LM358A	LM2904 LM2904Q	UNIT			
Supply voltage, V <sub>CC</sub> (see Note 1)	MIN WN	32	26	V			
Differential input voltage, VID (see Note 2)	WW WT	±32	±26	V			
Input voltage, VI (either input)	COM-	-0.3 to 32	-0.3 to 26	V			
Duration of output short circuit (one amplifier) to ground at (or below) 25°C free-air temperature (V <sub>CC</sub> $\leq$ 15 V) (see Note 1	3) 014	Unlimited	Unlimited				
Operating virtual junction temperature, TJ	150	150	S₀ ∖				
. W.1001. W.100	D package	97	97				
	P package	85	85	•CAN			
Package thermal impedance, $ heta_{JA}$ (see Notes 4 and 5)	PS package	95	95	°C/W			
	PW package	149	149				
	FK package	5.61		0044			
Package thermal impedance, $\theta_{JC}$ (see Notes 6 and 7)	JG package	14.5	00	°C/W			
WWWW. ONV.CO. TW WW	LM158, LM158A	-55 to 125	1001.0-	TA			
CONT AND	LM258, LM258A	-25 to 85	.Vo				
Operating free-air temperature range, TA	LM358, LM358A	0 to 70	1.10-51	°C			
	LM2904, LM2904Q		-40 to 125				
Case temperature for 60 seconds	FK package	260	×100Y	°C			
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds	JG package	300	300	°C			
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	P package	260	260	°C			
Storage temperature range, T <sub>stg</sub>	WW.100X.CON	-65 to 150	-65 to 150	°C			

<sup>†</sup> Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. All voltage values, except differential voltages and V<sub>CC</sub> specified for measurement of I<sub>OS</sub>, are with respect to the network ground terminal.

- 2. Differential voltages are at IN+ with respect to IN-.
- 3. Short circuits from outputs to V<sub>CC</sub> can cause excessive heating and eventual destruction.
- 4. Maximum power dissipation is a function of T<sub>J</sub>(max), θ<sub>JA</sub>, and T<sub>A</sub>. The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(max) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.
- The package thermal impedance is calculated in accordance with JESD 51-7. 5.
- Maximum power dissipation is a function of T<sub>J</sub>(max),  $\theta_{JC}$ , and T<sub>C</sub>. The maximum allowable power dissipation at any allowable case 6. WW.100Y.COM temperature is  $P_D = (T_J(max) - T_C)/\theta_{JC}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.

7. The package thermal impedance is calculated in accordance with MIL-STD-883.



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# electrical characteristics at specified free-air temperature, V<sub>CC</sub> = 5 V (unless otherwise noted)

P	ARAMETER	TEST CONDITIONS <sup>†</sup>		√ т <sub>А</sub> ‡		.M158 .M258	v.C	M.I.	.M358		UNIT
		W.100	COM.1		MIN	TYP§	MAX	MIN	TYP§	MAX	-
10×.		$V_{CC} = 5 V to$		25°C	NY T	3	5	CO <sub>M</sub> .	3	7	
VIO	Input offset voltage	$V_{IC} = V_{ICR}(r)$ $V_{O} = 1.4 V$	nin),	Full range	N	Win	7 00	COM		9	mV
$\alpha_{V_{IO}}$	Average temperature coefficient of input offset voltage	WWW.	100Y.CON	Full range		7	N.100	X.CON	7	N	μV/°C
10,100	Input offset current	V <sub>O</sub> = 1.4 V	N 100Y.C	25°C		2	30	01.	2	50	nA
.10		10-111	V.F.	Full range		WW	100	MY.C		150	1
α <sub>l</sub> <sub>IO</sub>	Average temperature coefficient of input offset current	VV VV	WW.100Y.	Full range	N	10	AMA MAN.	.100Y.	10	1.1%	pA/°0
lin (	Input bias current	V <sub>O</sub> = 1.4 V	WW.100	25°C		-20	-150	N.100	-20	-250	nA
IВ	input bias current	VO = 1.4 V	N Y 100	Full range	1.1.		-300	N.100		-500	
	Common-mode		MAX 10	25°C	0 to V <sub>CC</sub> -1.8	5	W.V.	0 to V <sub>CC</sub> -1.5		MO	V
VICR	input voltage range	$V_{CC} = 5 V \text{ to } N$		Full range	0 to V <sub>CC</sub> -2	V	Z	0 to V <sub>CC</sub> -2	1001	.cov	v
	W.ION COM	$R_L \ge 2 k\Omega$	WW	25°C	V <sub>CC</sub> -1.5			V <sub>CC</sub> -1.5	- 01	1.00	
N.	High-level	R <sub>L</sub> ≥ 10 kΩ		25°C	01.3		2		1.700		M.
∨он	output voltage	V <sub>CC</sub> = MAX	$R_L = 2 k\Omega$	Full range	26	L.M.		26	x1 10		V
				 R <sub>I</sub> ≥ 10 kΩ	Full range	27	28	-	27	28	04.4
VOL	Low-level output voltage	$R_L \le 10 \ k\Omega$	WV	Full range	A.COM	5	20	WY	5	20	mV
	Large-signal	V <sub>CC</sub> = 15 V,		25°C	50	100	N	25	100	1.100.	
AVD	differential voltage amplification	$V_0 = 1 V \text{ to } 1$ $R_L = \ge 2 k\Omega$	1 V,	Full range	25	ant.	L.M.	15	N 44	N.10	V/m∖
CMRR	Common-mode rejection ratio	$V_{CC} = 5 V to$ $V_{IC} = V_{ICR}(r)$		25°C	70	80	TW.	65	80	1.17	dB
<b>k</b> SVR	Supply-voltage rejection ratio $(\Delta V_{DD}/\Delta V_{IO})$	$V_{CC} = 5 V to$		25°C	65	100	M.T	65	100	WW.	dB
V <sub>O1</sub> /V <sub>O2</sub>	Crosstalk attenuation	f = 1 kHz to 2	0 kHz	25°C	-x 10	120	M.		120		dB
	WWW	V <sub>CC</sub> = 15 V,	Vid = 1 V.	25°C	-20	-30		-20	-30	M <sub>M</sub>	
		$V_0 = 0$	ONL.	Full range	-10	N	COM	-10		WV	
ю	Output current	V <sub>CC</sub> = 15 V,	$V_{ID} = -1 V_{i}$	25°C	10	20	$c0^{1}$	10	20		mA
		V <sub>O</sub> = 15 V	M.TW	Full range	5	100,	- CO	5			4
		$V_{ID} = -1 V$ ,	V <sub>O</sub> = 200 mV	25°C	12	30	1.00	12	30		μA
los	Short-circuit output current	V <sub>CC</sub> at 5 V, 0 V <sub>O</sub> = 0	GND at –5 V,	№ 25°C	MM	±40	±60	On-	±40	±60	mA
		V <sub>O</sub> = 2.5 V,	No load	Full range	N.	0.7	1.2		0.7	1.2	
ICC	Supply current (two amplifiers)	V <sub>CC</sub> = MAX, No load		Full range		1	2		1	2	mA

<sup>†</sup> All characteristics are measured under open-loop conditions with zero common-mode input voltage, unless otherwise specified. MAX V<sub>CC</sub> for testing purposes is 26 V for the LM2904 and 30 V for others.

<sup>‡</sup> Full range is  $-55^{\circ}$ C to 125°C for LM158,  $-25^{\circ}$ C to 85°C for LM258, 0°C to 70°C for LM358, and  $-40^{\circ}$ C to 125°C for LM2904 and LM2904Q. § All typical values are at T<sub>A</sub> = 25°C.



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#### electrical characteristics at specified free-air temperature, V<sub>CC</sub> = 5 V (unless otherwise noted)

1001.0	PARAMETER			T <sub>A</sub> ‡	LM2904 LM2904Q			UNIT
		1001. COM		WW.10	MIN	TYP§	MAX	
VIO	Input offset voltage	$V_{CC} = 5 V \text{ to } M_{A}$	4Χ,	25°C	00 r.	3	7	mV
VIO -	input onset voltage	VIC = VICR(min	), V <sub>O</sub> = 1.4 V	Full range	1001.0	A	10	IIIV
$\alpha_{V_{IO}}$	Average temperature coefficient of input offset voltage	N.100Y.CC	M.TW	Full range	.100Y.	7	TW	μV/°C
	Input offset current	V <sub>O</sub> = 1.4 V	WT.M	25°C	x 100 x	2	50	nA
10	input onset current	VO = 1.4 V	WT	Full range	00	Y.CO.	300	N NA
α <sub>I</sub> IO	Average temperature coefficient of input offset current	WW.100Y	CONTRA	Full range	W.10	10	M.I	pA/°C
WWW	No. CONTRACTOR		Y.C.	25°C		-20	-250	
ΙB	Input bias current	V <sub>O</sub> = 1.4 V		Full range	INN.	. No	-500	nA
	W100 X.COM.1		AVALCOM T	25°C	0 to V <sub>CC</sub> -1.5	1001	.CO	V
VICR	Common-mode input voltage range	$V_{CC} = 5 V$ to MAX		Full range	0 to V <sub>CC</sub> -2	W.100	N.CO	DM.
7	THE TOOL OF THE	$R_L \ge 2 k\Omega$		25°C		WN.10	01	Mo
V	High-level output voltage	$R_L \ge 10 \ k\Omega$		25°C	V <sub>CC</sub> -1.5	-11	001.	V
VOH		V <sub>CC</sub> = MAX	$R_L = 2 k\Omega$	Full range	26	MM.	V.	CO
	WT 1001. COMITY	VCC = MAX	$R_L \ge 10 \ k\Omega$	Full range	23	24	Too	1 CO
VOL	Low-level output voltage	$R_{L} \le 10 \ k\Omega$	1001.0	Full range		5	20	mV
A	Large-signal differential	V <sub>CC</sub> = 15 V, V <sub>C</sub>	) = 1 V to 11 V,	25°C	25	100	-110	V/m
AVD	voltage amplification	$R_L = \ge 2 k\Omega$	WW. LOS WWW	Full range	15	WW	14.2	V/m
CMRR	Common-mode rejection ratio	$V_{CC} = 5 V \text{ to } M_{V}$ $V_{IC} = V_{ICR}(\text{min})$		25°C	50	80	NN.	dB
ksvr	Supply-voltage rejection ratio $(\Delta V_{DD}/\Delta V_{IO})$	$V_{CC} = 5 V \text{ to } M_{A}$	AX	25°C	65	100	N N	dB
V <sub>O1</sub> /V <sub>O2</sub>	Crosstalk attenuation	f = 1 kHz to 20 k	Hz	25°C	TW	120		dB
	WWW. any.Cu			25°C	-20	-30	AM.	-1
		V <sub>CC</sub> = 15 V, V <sub>IE</sub>	0 = 1 V, VO = 0	Full range	-10		N	
I <sub>O</sub>	Output current			25°C	10	20		mA
		$v_{CC} = 15 v, v_{IE}$	o = −1 V, V <sub>O</sub> = 15 V	Full range	5		N	
	WWW.1001	$V_{ID} = -1 V,$	V <sub>O</sub> = 200 mV	25°C	The	30		μA
los	Short-circuit output current	V <sub>CC</sub> at 5 V, GN	D at –5 V, V <sub>O</sub> = 0	25°C	COM	±40	±60	mA
	Supply ourront (two omnilifiand)	V <sub>O</sub> = 2.5 V,	No load	Full range	COM.	0.7	1.2	A
ICC	Supply current (two amplifiers)	VCC = MAX, VC	) = 0.5 V, No load	Full range		1	2	mA

<sup>†</sup> All characteristics are measured under open-loop conditions with zero common-mode input voltage, unless otherwise specified. MAX V<sub>CC</sub> for testing purposes is 26 V for the LM2904 and 30 V for others.

<sup>‡</sup> Full range is  $-55^{\circ}$ C to  $125^{\circ}$ C for LM158,  $-25^{\circ}$ C to  $85^{\circ}$ C for LM258,  $0^{\circ}$ C to  $70^{\circ}$ C for LM358, and  $-40^{\circ}$ C to  $125^{\circ}$ C for LM2904 and LM2904Q. § All typical values are at T<sub>A</sub> =  $25^{\circ}$ C.



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#### LM158, LM158A, LM258, LM258A LM358, LM358A, LM2904, LM2904Q DUAL OPERATIONAL AMPLIFIERS SLOS068E - JUNE 1976 - REVISED SEPTEMBER 2002

## electrical characteristics at specified free-air temperature, V<sub>CC</sub> = 5 V (unless otherwise noted)

	ARAMETER	TEST CONDITIONS <sup>†</sup>		- +		LM158A			LM258A			
V.COP	ARAMETER	TEST CO	NDITIONS	TA <sup>‡</sup>	MIN	TYP§	MAX	MIN	TYP§	MAX	UNIT	
CO <sup>1</sup>		$V_{CC} = 5 V tc$	$V_{CC} = 5 V \text{ to } 30 V,$ $V_{IC} = V_{ICR(min)},$		W	NN.,	2	COM.	2	3		
VIO	Input offset voltage	$V_{IC} = V_{ICR}(r)$ $V_{O} = 1.4 V$	min),	Full range	1	M.W.	4	COM	WT	4	mV	
α <sub>VIO</sub>	Average temperature coefficient of input offset voltage	WWW.	100Y.CO	Full range		7	15*	V.COM	7	15	μV/°C	
100	Input offset current	V <sub>O</sub> = 1.4 V	N.100 - C	25°C	1	2	10		2	15	nA	
liO	input onset current	VO = 1.4 V	AL 100Y.	Full range		NN .	30	00	M.	30	IIA	
α <sub>l</sub> <sub>IO</sub>	Average temperature coefficient of input offset current	WW		Full range		10	200	100X.	(10	200	pA/°0	
WW.	Input bias current	V <sub>O</sub> = 1.4 V	AM.	25°C	WT	-15	-50	001	-15	-80	nA	
<sup>I</sup> IB	input bias current	VO = 1.4 V	WW.Ios	Full range	I		-100	N.1-	V.CC	-100		
VICR	Common-mode	V <sub>CC</sub> = 30 V		25°C	0 to V <sub>CC</sub> –1.	5	W	0 to V <sub>CC</sub> -1.5	OY.C	0 <sub>W</sub> ,	NV.	
VICR	input voltage range			WWW.	Full range	0 to V <sub>CC</sub> –2	N	N	0 to V <sub>CC</sub> –2	100Y.		N.
WWW INDY.COM	$R_L \ge 2 k\Omega$	NW.	25°C	V <sub>CC</sub> -1.	5		V <sub>CC</sub> -1.5	1007		W.L.A.		
Vон	High-level output voltage	V <sub>CC</sub> = 30 V	$R_L = 2 k\Omega$	Full range	26	W		26	100	1.00	V	
	NN.1003 CO		$R_L \ge 10 \ k\Omega$	Full range	27	28		27	28	N.C	) Mr.	
VOL	Low-level output voltage	$R_L \le 10 \ k\Omega$		Full range	I.CON	5	20	WW	5	20	mV	
	Large-signal	V <sub>CC</sub> = 15 V,		25°C	50	100	N	50	100	Yoo1		
AVD	differential voltage amplification	$V_{O} = 1 V \text{ to } T$ $R_{L} = \ge 2 k\Omega$	11 V,	Full range	25	JAT	W	25	MM	100	V/m\	
CMRR	Common-mode rejection ratio	.CONI.T	W	25°C	70	80	WT.	70	80	W.10	dB	
ksvr	Supply-voltage rejection ratio $(\Delta V_{DD}/\Delta V_{IO})$	y.co.	IW	25°C	65	100	LTW M.TV	65	100	NN.1	dB	
V <sub>O1</sub> /V <sub>O2</sub>	Crosstalk attenuation	f = 1 kHz to 2	20 kHz	25°C		120	T	2	120		dB	
	WW.	V <sub>CC</sub> = 15 V,	V <sub>ID</sub> = 1 V,	25°C	-20	-30	-60	-20	-30	-60		
		V <sup>O</sup> = 0	MI	Full range	-10		·N·	-10		-TN	mA	
IO	Output current	V <sub>CC</sub> = 15 V,	$V_{ID} = -1 V$ ,	25°C	10	20	-ON	10	20			
		V <sub>O</sub> = 15	WT.	Full range	5	1001		5		N		
	Witz	$V_{ID} = -1 V, V$		25°C	12	30	y.CU	12	30	N	μA	
los	Short-circuit output current	V <sub>CC</sub> at 5 V, 0 V <sub>O</sub> = 0	1.00-11	25°C	WW	±40	±60	TIM	±40	±60	mA	
	Supply current (two	V <sub>O</sub> = 2.5 V, N		Full range	VW	0.7	1.2	UP-	0.7	1.2		
ICC	amplifiers)	V <sub>CC</sub> = MAX, No load	$V_{O} = 0.5 V,$	Full range	W	1	2		1	2	mA	

\*On products compliant to MIL-PRF-38535, this parameter is not production tested.

<sup>†</sup> All characteristics are measured under open-loop conditions with zero common-mode input voltage, unless otherwise specified. MAX V<sub>CC</sub> for testing purposes is 26 V for LM2904 and 30 V for others.

<sup>‡</sup> Full range is –55°C to 125°C for LM158A, –25°C to 85°C for LM258A, and 0°C to 70°C for LM358A.

§ All typical values are at  $T_A = 25^{\circ}C$ .

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#### LM158, LM158A, LM258, LM258A LM358, LM358A, LM2904, LM2904Q DUAL OPERATIONAL AMPLIFIERS

SLOS068E - JUNE 1976 - REVISED SEPTEMBER 2002

#### 勝特力材料 886-3-5753170 胜特力电子(上海) 86-21-54151736 胜特力电子(深圳) 86-755-83298787 Http://www.100y.com.tw

#### electrical characteristics at specified free-air temperature, V<sub>CC</sub> = 5 V (unless otherwise noted)

1001.0	DADAMETED	101.	The second	100		M358A		
	PARAMETER	TEST CO	ONDITIONS <sup>†</sup>	TA‡	MIN	TYP§	MAX	UNIT
		$V_{CC} = 5 V \text{ to } 30$	) V,	25°C	N.CO	2	3	mV
VIO	Input offset voltage	VIC = VICR(min	n), V <sub>O</sub> = 1.4 V	Full range		0 <sub>M·r</sub>	5	mv
α <sub>VIO</sub>	Average temperature coefficient of input offset voltage	N.100Y.CC	M.TW	Full range	1001.	017	20	μV/°C
-W.10	Input offect ourrent		ONL.	25°C	.100	2	30	~^
10	Input offset current	V <sub>O</sub> = 1.4 V	M.TW	Full range	N.100 *		75	nA
α <sub>IIO</sub>	Average temperature coefficient of input offset current	WW.100Y.	COMITW	Full range	W.100	10	300	pA/∘C
	logut biog gurrant	V <sub>O</sub> = 1.4 V	CONT	25°C	N.W.IU	-15	-100	
IВ	Input bias current	VO = 1.4 V		Full range	1	001.	-200	nA
WW		WWWWWWWWWWWWWWWW		25°C	0 to V <sub>CC</sub> -1.5	100Y.		1.17
VICR	Common-mode input voltage range	V <sub>CC</sub> = 30 V		Full range	0 to V <sub>CC</sub> -2	1.100	N.CO	v
	W.IUW COM.	$R_L \ge 2 k\Omega$	.100 COM	25°C	V <sub>CC</sub> -1.5	W.10	N.C	DMr.
Vон	High-level output voltage	No. 20.V	$R_L = 2 k\Omega$	Full range	26	W.IC	ju -	V.
		V <sub>CC</sub> = 30 V	$R_L \ge 10 \ k\Omega$	Full range	27	28	00x.	Mo
VOL	Low-level output voltage	$R_L \le 10 \ k\Omega$	W. ONY.CO	Full range	V	5	20	mV
A	Large-signal differential	V <sub>CC</sub> = 15 V, V <sub>C</sub>	) = 1 V to 11 V,	25°C	25	100	.1.	V/mV
AVD	voltage amplification	$R_L = \ge 2 k\Omega$	W.1001.	Full range	15		N.100	v/mv
CMRR	Common-mode rejection ratio	N N	100Y.	25°C	65	80	×10	dB
<b>SVR</b>	Supply-voltage rejection ratio $(\Delta V_{DD}/\Delta V_{IO})$	W1	WWW.100Y	25°C	65	100	NW.1	dB
V01/V02	Crosstalk attenuation	f = 1 kHz to 20 k	<hz 100<="" td=""><td>25°C</td><td></td><td>120</td><td>AL N</td><td>dB</td></hz>	25°C		120	AL N	dB
	WWWWWWWWY.CO.	V <sub>CC</sub> = 15 V, V <sub>II</sub>	ς = 1 V,	25°C	-20	-30	-60	1004
		$V_{O} = 0$	WWW.IC	Full range	-10		NWN	mA
0	Output current	V <sub>CC</sub> = 15 V, V <sub>II</sub>	_ = −1 V,	25°C	10	20	W	IIIA
		V <sub>O</sub> = 15 V	W.	Full range	5			W.10
	WWW. DOX.C	$V_{ID} = -1 V, V_{O}$	= 200 mV	25°C	WILL	30		μA
OS	Short-circuit output current	V <sub>CC</sub> at 5 V, GN V <sub>O</sub> = 0	D at –5 V,	25°C	M.TV	±40	±60	mA
	NWW 1005	V <sub>O</sub> = 2.5 V, No	load	Full range	L.Mo.	0.7	1.2	
ICC	Supply current (two amplifiers)	V <sub>CC</sub> = MAX, V <sub>C</sub> No load	O = 0.5 V	Full range	CON.	1	2	mA

<sup>†</sup> All characteristics are measured under open-loop conditions with zero common-mode input voltage, unless otherwise specified. MAX V<sub>CC</sub> for WWW.100Y.COM.T testing purposes is 26 V for LM2904 and 30 V for others.

<sup>‡</sup> Full range is –55°C to 125°C for LM158A, –25°C to 85°C for LM258A, and 0°C to 70°C for LM358A.

§ All typical values are at  $T_A = 25^{\circ}C$ .





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-1 C	PARAMETER	TEST CONDITIONS        RL = 1 MΩ, CL = 30 pF, VI = ±10 V	TYP	
SR	Slew rate at unity gain	(see Figure 1)	0.3	V/µs
B <sub>1</sub>	Unity-gain bandwidth	$R_L = 1 M\Omega$ , $C_L = 20 pF$ (see Figure 1)	0.7	MHz
Vn	Equivalent input noise voltage	$R_S = 100 \Omega$ , V <sub>I</sub> = 0 V, f = 1 kHz (see Figure 2)	40	nV/√H

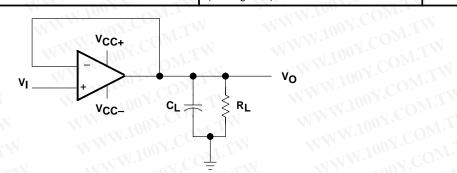
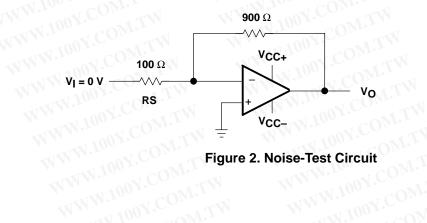


Figure 1. Unity-Gain Amplifier



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